

The “Anything Goes” Band

A *Focus On Broadband Wireless Internet Access* newsletter Special Report

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This is a special report on a paradigm-breaking new spectrum proposal is a special publication of *Focus On Broadband Wireless Internet Access* newsletter. More information on *Focus* is available at <http://www.strohpub.com/focus>

This is a preliminary release of this report. The full report, with considerably more detail, analysis and interviews with additional key individuals will be available in July, 2002.

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Disclaimer

Much as it pains the author to inject legal phraseology into this document, prudence dictates that it be done.

In this document, the author discusses events and possible scenarios regarding license-exempt spectrum management and the Broadband Wireless Internet Access industry and related topics to the best of his ability and current knowledge.

The reader should consider this document to be “well-informed speculation”. More to the point, the reader should consider this document to largely represent one person’s *opinion*.

The author specifically prohibits the use of this report as the basis of investment decisions, legal proceedings of any kind, policy decisions, and any other use other than education on the issues discussed.

When making decisions about the issues discussed in this report, the reader should conduct their own independent research to verify or elaborate on any information stated within this report.

Abstract

A seminal event in the long, contentious history of spectrum allocation in the United States was held on May 12-14, 2002. The occasion was a conference called *Spectrum and Services Beyond 3G; The First Annual Workshop on Spectrum Allocation and Assignment Policy*¹ held at the University of California in La Jolla, California.

Present at the conference was a critical confluence of a number of influential people, chief among them Reed Hundt, former FCC Chairman under President Clinton, now with McKinsey and Company, and three Senior FCC officials:

- Thomas Sugrue, Bureau Chief, Wireless Telecommunications Bureau (WTB)
- Ed Thomas, Chief, Office of Engineering Technology (OET)
- Donald Abelson, Bureau Chief, International Bureau (IB)

Several presenters at the conference presented bleak predictions for the long-term viability of the 3G mobile telephony industry. The only bright spot in the entire telecom industry, the state of which was characterized by several presenters as “being in a state of prolonged depression” was the nascent Wi-Fi² industry in all of its various permutations, especially enterprise and public wireless access points, better known as “Wireless Hot Spots”.

From accounts, it appears that a rare confluence of factors occurred at the conference:

- In preceding months a number of somewhat-related events had occurred, including the formation and increasing publicity of *The Open Spectrum Project*
- The “bad news” at the conference of a relatively bleak outlook for robust economic activity resulting from 3G services
- The “good news” of the impressive economic activity associated with “Wi-Fi”
- The presence of the right mix of representatives from the wireless industry, regulatory, analyst, and financial communities in an informal setting

The “confluence” appears to have triggered or gelled an idea for a new spectrum paradigm that would seek to leverage and expand on the success of “Wi-Fi”, but remove some or most of the onerous regulatory barriers that many claimed were holding back the “Wi-Fi” industry from being even more successful. Because of the relaxation of rules was a key element of this new band, it was tagged with the label of “The Anything Goes Band”. Of course, the name is not *literally* true – there will of course be at least minimal regulations, but the name is admittedly a catchy one, and has become firmly wedged in the minds of those who have heard of it, and no interesting-enough alternative name has yet been proposed, so this report, at least, will use the name

“The Anything Goes Band”.

¹ Conference web page - <http://www.calit2.net/events/2002/Spectrum/>

² Use of Wi-Fi; in the general public and popular press, the term Wi-Fi has become much more commonly used in place of the more technically accurate name of the IEEE 802.11b Wireless Local Area Network (WLAN) standard. Wi-Fi is a trademark of Wireless Ethernet Compatibility Alliance (WECA.)

Chapter 1

Executive Summary

The Anything Goes Band represents exciting and economically significant new possibilities on a number in a number of fields:

- The genesis of *The Anything Goes Band* is the surprising amount of economic activity being generated in products and services for the current license-exempt bands, despite the effects of an ongoing economic depression occurring in the telecom industry. Creating *The Anything Goes Band* would serve to accelerate and extend that economic activity.
- The key characteristic of *The Anything Goes Band* will be a relative lack of direct regulation. Instead of regulations being applied to operators of radios (the classic spectrum regulatory model), the (minimal) regulations will be “embedded” into the radios themselves. In such a model, the radios “decide” what modulation technique, time slots, and other parameters to use in a particular area. For example, if interference is encountered, a radio may well change modulation methods from “high throughput” to “more robust”.
- A key existing provision in the FCC rules for current license-exempt communications operation will be extended into *The Anything Goes Band*: each device operating in *The Anything Goes Band* will not have expectation of protection from interference, even when interference causes a device not to function properly. The entire point of *The Anything Goes Band* is to provide a band for new wireless services to continually emerge. For that to occur, for innovation to flourish, “squatter’s rights” cannot be tolerated. The only protection afforded for continued operation in *The Anything Goes Band* is continual technical innovation and evolution to cope with the varied and changing nature of competing uses of *The Anything Goes Band*. In short, *The Anything Goes Band* is deliberately biased towards innovation and continuous evolution of new technologies and services.
- The regulatory aspects and spectrum allocation of *The Anything Goes Band* are, for the moment, unique to the United States. This may have the effect of creating a market that is more favorable for US-based companies to develop and market new products and technologies, significantly in advance of such efforts in other countries
- New technologies will be required realize the fullness of possibilities of *The Anything Goes Band*. The technologies required will “play to the strengths” of US companies that are in the forefront of developing products such as digital signal processors, microprocessors, advanced modulation systems such as CDMA, software-defined / heuristic radios, smart / phased-array antennas, etc.
- New services, not feasible under current regulations and available spectrum, may become feasible using *The Anything Goes Band*. For example, Wireless Internet Service Providers must trade off cost of equipment for the use of high-gain, roof-mounted antennas and unobstructed line of sight between user antenna and base station. If higher transmit power was permitted in *The Anything Goes Band*, user equipment could likely

be made significantly less expensive and possible to use without resorting to roof-mounted antennas.

- New services that are made possible by the creation of *The Anything Goes Band* would be complementary to existing license-exempt bands; *The Anything Goes Band* is not intended to replace any existing license-exempt spectrum.
- A likely candidate spectrum for reallocation into *The Anything Goes Band* is the current Amateur Radio 1240-1300 MHz (1.24 – 1.30 GHz) band. Amateur Radio Operators³ and their national organization, the American Radio Relay League (ARRL)⁴, will undoubtedly object strenuously. Despite such objections, there are significant benefits to Amateur Radio operators to allow such a reallocation of spectrum. In the “bigger picture” of spectrum policy and benefit to society, there is ample precedent for reallocating Amateur Radio spectrum to other purposes. One relatively recent example is the creation of the Wireless Communications Service (WCS) band at 2.3 GHz by reallocation of Amateur Radio spectrum at 2.3 GHz.
- Radical changes in spectrum policy are not possible in existing license-exempt spectrum. There has been too much equipment produced that operates under current rules, there are too many constituencies highly motivated to maintain the status quo, and too fragile compromises made as the license-exempt rules evolved for there to be anything other than gradual, incremental changes made in current license-exempt (and other) spectrum⁵. Such gradual, incremental activity will not lead to the new services and technologies.
- It is projected by some that the only logical outcome of the current Telecom industry depression is a wave of bankruptcies occurring within the wireline service providers⁶. If so, for the industry to effectively restructure, an order of magnitude improvement in cost-effectiveness may be required. The existing cellular telephony networks and technology will not be able to scale sufficiently absorb the crush of wholesale wireline telephone replacement. The only place to develop, deploy, and effectively test the next generation of packet-based, spectrum-efficient wireless systems that would be required in such a scenario would be something very similar to *The Anything Goes Band*.
- In summary, for these and many other reasons (some detailed in the pages that follow), it is in the overall best interest of the citizens and companies of the United States as a whole that *The Anything Goes Band* should be created.

³ For full disclosure, the author is a licensed Amateur Radio operator

⁴ For full disclosure, the author is a member of the ARRL

⁵ Perhaps a part of the genesis of *The Anything Goes Band* is the concept of “Radio Havens” such as cooperative lesser-developed countries that are willing to offer considerably more flexibility in spectrum regulation than the US... and the possibility that development of wireless technology, products, and services would in fact shift to countries offering such “Radio Havens”.

⁶ Cook Report, April and May, 2002 issues for telco industry collapse, June/July 2002 issue for a discussion of whether license-exempt wireless could be a solution to the collapse. <http://www.cookreport.com>

Chapter 2

The Open Spectrum Project

The idea of “Open Spectrum” evolved from the chaotic and incredibly productive example of “Open Source” software, most notably in the development of the GNU/Linux derivative of the UNIX Operating System and the economic activity that was spawned from “something you couldn’t even charge money for.” Briefly, Open Source advocates the free and unfettered distribution of Operating System Source Code, making it available to anyone who wishes to see it and with appropriate skill, modify it, improve upon it, and contribute such changes or improvements back into the community for others to see it... etc.

Open Spectrum also evolved from the example of the various license-exempt bands currently available, where if the stated rules are observed in the manufacture and use of qualified radio equipment, no license to operate is required. The amount of economic activity resulting from the availability of license-exempt spectrum is a undeniable testament to the success of the license-exempt model of spectrum allocation. Many feel that such a model could be extended generally to many other parts of spectrum, and was badly needed.

The Open Spectrum Project was formed out of a May, 2001 workshop on spectrum policy that was held jointly by The Information Law Institute of the New York University School of Law and the Berkman Center for Institute and Society of Harvard University. The first Open Spectrum Project Workshop was held on May 18, 2001. Notes⁷ from that first meeting:

The open spectrum project, launched at the May, 2001 meeting, is to understand what is the best regulatory environment for license-free operation and to place that understanding on the public agenda.

The project brings together engineers, economists, technologists, and communications law specialists to design the best of all possible regulatory worlds, and to identify viable alternatives to that best case.

The object of the initial workshop and any working groups that may be spun out of it will be to examine the question of what would make license-free operation the most effective it could be, assuming that the needs of incumbents were not taken into account. The design question is, what regulatory framework would make license-free wireless communications most effective, usable with relatively inexpensive end-user equipment, in all communities, and to the extent possible, as a nationwide network. This should lead to the definition of a range of potentially optimal regulatory arrangements. Is ultrawideband operation below incumbent services the way to go? Should the U-NII Band be tweaked? Should the UHF band, slotted to be released by broadcasters as they move to DTV, be devoted to license-free high-speed data networking? Is any combination of these or similar solutions the best way to go from the perspective of building the best possible license-free infrastructure.

⁷Found at <http://www.law.nyu.edu/ili/spectrumpolicy.html>

Once we have developed a range of possible regulatory frameworks, we will work on defining the best possible configuration of regulatory changes from the current state, given the current licensing structure and the political realities of incumbency. The initial inquiry will however, create a baseline that will enable a much better informed selection among the politically-viable options.

Participants in Open Spectrum Project Workshop, May 18, 2001 —

Technologists: Jerome Saltzer, David Reed, Andy Lippman, Tim Shephard, Robert Morris, Frans Kaashoek, Dewayne Hendricks, Roberto Aiello, Dale Hatfield;

Economists: Jon Peha, Andrew Odlyzko, Carliss Baldwin;

Law/Policy: Susan Ness, Larry Lessig, Yochai Benkler, Charles Nesson, Jonathan Zittrain, Terry Fisher, Kevin Werbach, Jeff Chester, Michal Calabrese.

Space doesn't permit anything resembling a complete biography of the participants (and short biographies wouldn't offer a complete picture). Suffice it to say that all of the participants are highly qualified within their respective fields of expertise.

Once it was agreed to undertake the long-term challenge of making Open Spectrum a reality, given the high profiles and talent within in the group, it didn't take long for the idea of Open Spectrum to begin emerging in influential ways.

In the November, 2001 issue of Release 1.0 newsletter, Editor Kevin Werbach (who was present at the formational Open Spectrum meeting and is a former FCC staffer) devotes much of the issue to *Open Spectrum: The Paradise Of The Commons*. An excerpt:

Connectivity is a scarce resource. Building networks is difficult and expensive, something only a few companies can manage – telcos, cable operators, wireless carriers and satellite providers. Service providers control the fate of the Internet, as the gatekeepers to richer connections. The last mile into homes has become a broadband bottleneck, while high-speed wireless data services remain more wish than reality.

It doesn't have to be that way.

What if the scarcity and specificity of today's bandwidth options were artificial? What if wide-area network (WAN) connectivity were like that in local-area networks (LANs): a hardware choice under the control of the end-user? What if connectivity were shared by all rather than provided by a few?

It could happen. The new paradigm is open spectrum, and it requires only a few government decisions to open the floodgates for innovation. The rapid spread of 802.11b wireless LANs hints at the possibility of a wireless revolution as far-reaching and unexpected as the Internet was. So far, though, no government has considered the idea seriously. Open spectrum's disruptive potential is a political liability. If the technology industry wants to change the connectivity landscape for the better, now is the time to get involved.

Here's the concept in a nutshell: Instead of radio frequencies assigned exclusively to companies, spectrum would become a commons shared among users. Smart devices subject to rules ensuring that no one player could hog the airwaves would replace networks defined by governments and service providers. Bandwidth would be cheaper and more ubiquitous. Spectrum would be used

more efficiently. The gating factor for innovation would be vendors' ability to improve over time. . . and Moore's Law has long been a safe bet.

Wehrbach's description of the promise Open Spectrum was compelling and unusually eloquent. It was one of those rare pieces of writing about a technical subject that almost any reader could digest relatively easily and then proclaim "OK, got it!" That particular issue of Release 1.0 was very widely referenced and quoted.

By the timing, one of Wehrbach's readers was Rich Karlgaard, published of Forbes Magazine. In his January 21, 2002 "Digital Rules" editorial, titled *2002 Hangs On These*, Karlgaard wrote (excerpted):

Issue II: Open Spectrum

The personal computer took America by surprise, and then by storm, in the late 1970s. In 1982 *Time* magazine named the PC as its Man of the Year. But by 1985 the PC industry was as flat as today's Internet. Oh, it was still growing, just as Net usage in our day continues to grow. But the frisson had fizzled.

Then came powerful new computer chips, like Intel's 386. They made possible point-and-click, desktop engineering, desktop publishing and all the rest. By 1987 the PC industry was booming again. Don't you wish you had bought Intel and Microsoft then?

The Net will boom again, too. But it awaits a catalyst, just as PCs got their second wind 15 years ago from faster chips. The Net will get it by way of cheap, fast connections to homes and small offices--blink fast, fast enough for TV-quality videoconferencing. Bring it on, I say! Problem is, who will bring it? Laying fiber to the curb is hugely expensive. Large, old phone companies are hooked to shareholders who desire only reliable dividend checks. Scratch them. Little startup telcos are mostly filling the graveyards these days. Big European telcos toil and gasp under mountains of debt and could be going under next. Cable shows greater promise. But then, it always has. A talented underachiever, cable is starting to look like the Heisman Trophy winner who washes out in the pros.

The answer is cheap wireless. But here, once more, we bow to Washington policymakers. The U.S. government makes available too little wireless spectrum for what could turn out to be tomorrow's fastest-growing industry: wireless Web networks. Could turn out to be? Look how fast WiFi has grown with its tiny slice. The Federal Communications Commission needs to jettison its outdated view of spectrum rights. Today's blazing fast chips make it possible for messages--whether e-mail, voice or video--to zigzag through wide swaths of spectrum without bumping into anyone else's message. Chip technology permitting this miracle gets doubly good every 18 months. Which means our FCC's laws--which treat spectrum as a sort of real estate, complete with CCRs and fences--get doubly moronic every year and a half.

The appropriate metaphor for spectrum in the 21st century is the ocean, not real estate. Boats make one guarantee--to avoid one another--then the ocean is pretty much theirs to use. Similarly, e-mail, voice and video should be free to travel the entire sweep of God's airwaves. Only one law need apply: Don't interfere.

Memo to Michael Powell: Here's your chance to become the most famous FCC chairman in history and rescue the American economy in one bold stroke.

Karlgaard's editorial was widely noted; his "spectrum as ocean" metaphor quoted widely and Open Spectrum was... out in the open.

David Reed, also present at the formational meeting of Open Spectrum has testified on the concepts of Open Spectrum at a number of conferences and at the FCC itself. In a May 19, 2002 column, popular San Jose Mercury News Technology columnist Dan Gillmor wrote about a recent Reed presentation (excerpted):

It's long been an article of faith that the airwaves are a scarce resource. On this notion rides the existence of the Federal Communications Commission, which regulates the airwaves, not to mention the ownership of great swaths of the spectrum by a variety of public and private interests.

What if the scarcity turns out to be an artifact of history and outmoded technology? That's not a new thought, but it's back on the table for discussion in tech and policy circles. If scarcity can be overcome, the implications are both exciting and disruptive -- a cornucopia of communications that foreshadows woes for some of our biggest telecommunications companies. Late last month, David P. Reed gave a provocative talk to the Federal Communications Commission's Technological Advisory Council. He told the group of experts, in effect, that the FCC's fundamental mission is flawed, maybe obsolete.

Reed wants the FCC to open up some spectrum for these more open wireless networks, giving entrepreneurs a new public space in which to innovate and create value for the rest of us. He's not sure who'll make money in this space, but surely equipment manufacturers and other companies, especially software companies, will be in the middle of a wave of innovation.

Software is a key, perhaps the key, to the future Reed envisions. Most radio-like devices using today's spectrum -- radios, televisions, mobile phones and the like -- are based on the old way of doing things, constrained by hardware to receive and transmit signals in specific ways and in specific places of the airwaves.

To get the capacity multiplier effect, he said, we need devices with fairly generic but powerful hardware components. "Software defined radios" will be vastly more adaptable, and useful, than their old-fashioned cousins, according to Reed and others who are promoting the concept. The military has been using these devices, also called "agile radio," for some time; civilian availability is getting closer as costs come down.

The excerpts of Werbach's, Karlgaard's, and Gillmor's writing are just a sampling of the sum total that has been written about the concepts of Open Spectrum in the months since the formation of the Open Spectrum Project. Open Spectrum has received such a widespread and favorable reception that it seems inevitable that FCC staffers such as Ed Thomas would have been encountered it in the course of their jobs at the FCC.

That the concepts of Open Spectrum *are* so fully formed and well thought-out would seem to argue strongly for the likely success of *The Anything Goes Band*. As will be illustrated in subsequent chapters, the ideas for *The Anything Goes Band* are by no means new, or springing forth solely from the FCC.

Chapter 3

The Seminal Event

Prior to the conference, a number of trends were weighing directly or indirectly on the FCC, some positive, most negative:

- The prolonged, surprisingly brutal telecom downturn that killed numerous companies, severely wounded many others, and substantially reduced competition for telecom services
- The economic aftereffects of the September 11, 2001 terrorist attacks
- Post September 11, 2001, the drastic change in priorities for spectrum controlled by NTIA, now badly needed for a new kind of warfare in which wireless technologies would play the most critical role to date, resulting in almost no spectrum being available for reallocation to “3G” mobile telephone services as requested by the mobile telephone industry
- The slow rollout and changing promises and expectations about just what was “3G” mobile telephone services going to be able to do... *exactly*
- The hoped-for vacation of television broadcasters from television channels 52-69 was highly unlikely before the very end of the specified period... resulting in no early availability of prime 700 MHz spectrum
- The slow realization in both the mobile telephone industry, their financial backers, and regulators that between the costs of purchasing spectrum at auction, the additional base station sites that would be needed, the new equipment that would be needed, and unanticipated consumer indifference to potentially lucrative enhanced “3G” service all combined to scale back previous rosy predictions of profits to be made from “3G” upgrades.
- The surprising (to some, not surprising to many others) economic activity being generated by use of license-exempt spectrum at 2.4 GHz and 5 GHz, especially consumer and enterprise sales of Wireless Local Area Network (WLAN) equipment, especially equipment based on the increasingly popular 802.11b WLAN standard (“Wi-Fi”)
- Emergence of numerous commercial “Wireless Hot Spots” and very significant economic activity relating to the “Wi-Fi” industry— new companies being formed, investments being made, healthy sales volumes
- Emergence of “Wireless Community Networks” and the wide publicity they enjoyed and the rampant speculation that their existence would largely displace the need for data services over “3G” mobile telephone networks
- Emergence of “Wireless Internet Service Providers, increasingly capable of providing broadband services in the absence of cable modem and DSL services, especially in rural areas where broadband services are limited

- Growing fears that technical innovation in wireless communications would increasingly shift to countries with more spectrum policies that allowed for greater innovation and made more spectrum available for commercial use
- Lack of progress in the availability of broadband services, and often lack of choice of broadband service providers in the aftermath of numerous failures of Competitive Local Exchange Carriers (CLECs)
- The formation of “The Open Spectrum Project” (detailed in a previous chapter)

With that daunting context, the *Spectrum and Services Beyond 3G; The First Annual Workshop on Spectrum Allocation and Assignment Policy*⁸ conference was held on May 12-14, 2002 at the University of California in La Jolla, California⁹.

Present at the conference was a critical confluence of a number of influential people, chief among them Reed Hundt, former FCC Chairman under President Clinton, now with McKinsey and Company, and three Senior FCC officials:

- Thomas Sugrue, Bureau Chief, Wireless Telecommunications Bureau (WTB)
- Ed Thomas, Chief, Office of Engineering Technology (OET)
- Donald Abelson, Bureau Chief, International Bureau (IB)

Hundt's was one of the primary presentations at the conference, and the audience was attentive. As a Senior Advisor at McKinsey and Company, Hundt had impressive statistics at his command. Some key points from Hundt's presentation (paraphrased):

- The telecom industry is in a depression... the worst since the industry was founded in 1876 when the telephone was invented
- Current and future (3G) mobile telephony is part of the same paradigm (circuit switched technology) as Public Switched Telephone Network (PSTN) and will likely experience the same fate.
- What is most likely to survive the telecom depression is easy-to-deploy, inexpensive, license-exempt technologies such as “Wi-Fi”
- The best thing that the FCC could do for the future of telecom is to “get out of the way” of license-exempt technologies, deny all competing claims in license-exempt spectrum (such as Amateur Radio’s primary status in part of the 2.4 GHz band) and *allocate more spectrum* for license-exempt operations

The same evening that Hundt spoke, Ed Thomas, Chief of FCC's OET began to discuss the idea of actually implementing Hundt's suggestion that more spectrum be allocated for license-exempt use. Likely influenced by the ideas proposed by The Open Spectrum Project, Thomas proposed only a few key requirements:

- License-exempt operation
- No particular service or use specified

⁸ Conference web page - <http://www.calit2.net/events/2002/Spectrum/>

⁹ The author did not attend this conference; all information related in Chapter 3 results from interviews and other post-event information such as presentation slides.

- Very strict limits on out of band emissions
- At least 50 MHz of spectrum, below 5 GHz would be required
- Easing of transmit power limitations compared to ISM and UNII band operation
- No modulation method specified – “UNII without the power limits”
- Minimal rules (clean sheet of paper compared to ISM and UNII)

Thomas' discussions were warmly received and judged quite achievable by all who heard the idea. There was some discussion of likely candidates for spectrum, and it was suggested that spectrum near 1200 MHz would be a good fit for the stated requirements. The next morning, Thomas called FCC OET Deputy Chief Julius Knapp and asked him to begin working on the idea of what has become known as *The Anything Goes Band*. In a wrapup session at the end of the conference, mention was made that *The Anything Goes Band* was now under consideration, and most of those in attendance did not seem surprised; apparently word of the idea had already made the rounds of the attendees.

If *The Anything Goes Band* does become reality, it would appear that the Open Spectrum Project may have its first chance at Proof-of-concept.

Chapter 4

A Post-event Interview with Ed Thomas

In an interview regarding *The Anything Goes Band*, Ed Thomas was surprised to learn that the ideas he expressed at the *Spectrum and Services...* conference regarding *The Anything Goes Band* had “propagated” so quickly, especially to a member of the press.

During the interview, Thomas was at pains to make a number of points:

- *The Anything Goes Band* is, just an idea, in the very formative stages
- The ideas on *The Anything Goes Band* are a result of existing, on-going FCC staff work. The FCC conducts internal studies such as *The Anything Goes Band* quite regularly; the vast majority of such proposals never see the light of day
- Thomas reluctantly admitted that profile of *The Anything Goes Band* idea has been “elevated significantly” and has been receiving far more interest than he had anticipated
- The FCC feels that its most important role is that of an enabler, and thus the primary goal of *The Anything Goes Band* is to encourage innovation
- The FCC feels it has done a good job with the ISM / Part 15.247, and more recently the UNII rules. The main reason for *The Anything Goes Band* is to see if transmitter power levels can perhaps be relaxed and if doing so would increase innovation
- The FCC does not mandate, or encourage, or discourage particular technologies; it won’t play favorites
- The *The Anything Goes Band* is not a response to any particular current use of license-exempt spectrum, but rather a response to *all the current uses* of license-exempt spectrum
- No specific spectrum or band has been chosen or is under active consideration. The only strong criteria so far are ~ 50 MHz of spectrum, above 50 MHz and below 5 GHz
- The FCC recognizes the potential for interference in license-exempt spectrum, but using license-exempt spectrum comes with absolutely no guarantees. “... industry knew the rules...” while they’re selling products that operate in license-exempt spectrum
- When it was noted that the Amateur Radio 1240-1300 MHz band fits all the stated requirements for *The Anything Goes Band* and is relatively little-used by Amateur Radio operators, Thomas restated emphatically that no specific spectrum or band had yet been identified for *The Anything Goes Band* and if an Amateur Band were to be selected, doing so would require the support of “... the Hams and the ARRL.”

In closing, Thomas and the other FCC personnel present at the *Spectrum and Services...* conference are to be commended. They’re out in the real world, gathering varied real world input instead of relying solely on lobbyists and reports.

Chapter 5

A Post-event Interview with Reed Hundt

(to be completed)

Chapter 6

What's Wrong With The Existing License-exempt Bands?

(to be completed)

- Encumbered by other services
- Too many rules (complexity of Part 15)
- Power levels are too low
- Needs to be lower in spectrum – not enough bandwidth at 900 MHz, 2.4 killed by foliage

Chapter 7

What's Right With the Existing License-exempt Bands?

(to be completed)

- Selection of bands – 900, 2.4 GHz, 5 GHz, 60 GHz, FSO, UWB
- UNII rules simple, work, lots of equipment on the market

Chapter 8

The Competitive Landscape of the Current License-exempt Bands

(to be completed)

- Wireless Spectrum Finder is the seminal guide to spectrum allocations
- 902-928 MHz
- 2.4 – 2.485 GHz
- 5 GHz band (include new, telematics)
- 60 GHz
- FSO
- UWB

Chapter 9

The Darwinian Effect Of License-exempt Wireless

(to be completed)

- Insert and update essay on Darwinian Effect Of License-exempt Wireless

Chapter 10

The Potential User Bases of the Anything Goes Band

(to be completed)

- Wireless LANs already well served by low power use of 2.4 and 5 GHz
- “SCADA” users now using 900 MHz equipment
- Scientific users needing longer range
- Wireless Internet Service Providers
 - a. Longer range base station to customer
 - b. Inexpensive point-point links
 - c. Vastly improved foliage penetration
- Wireless Community Networks
 - a. Linking between nodes
- Experimenters / Amateur Radio operators

Chapter 11

How Would Amateur Radio React... And Does It Matter?

(to be completed)

- Very little of Amateur Radio spectrum is exclusive. Most is shared, for example US 420-450 MHz band is US Navy RADAR
- Changes in allocation is long-established history with Amateurs – continually relegated higher and higher in the spectrum, examples 220-222 MHz, 2.3 GHz band reallocated to Wireless Communications Service (WCS)
- ARRL will be primary obstacle, will likely “cock and fire” its “lobbying gun”
- Despite a small resurgence in activity due to Homeland Security, use of Amateur Radio for emergency communications is declining; being replaced by Nextel DirectConnect and satellite telephones
- Cadre of Community Wireless Networks now offering more “current century relevant” emergency services; quick setup of Wireless LAN, understanding of TCP/IP interoperability between emergency comms and LANs, fast speeds, “gets the email back up and running
- Amateur Radio has not embraced flexible spectrum use, but insists on channelized operation for repeater “channels for life”; FM technology dating from 1950’s, most repeaters are idle 99%+
- Leading edge of Amateur Radio experimenters and technically-minded will likely benefit from vastly increased amount of widely available, inexpensive equipment which can do long-range wireless networking. Hams will also be freed of contact restrictions.
- In realistic terms, likeliest result is very little impact to existing Hams

Chapter 12

Suggested Modifications to *Pure* “Anything Goes”

(to be completed)

Visions of the 21st Century Communications: Is the Shortage of Radio Spectrum for Broadband Networks of the Future a Self Made Problem?

by: Paul Baran, baran@com21.com

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SOME KINDERGARTEN RULES

To take the fullest advantage of our new technology with its sharing of a common resource requires that our smart transmitters and receivers cooperate. This may sound complicated, but the rules to make maximum effective use of the shared band are simple -- primarily a matter of common decency in sharing resources. The rules are somewhat similar to those you learned in kindergarten, assuming you lived in a tough neighborhood.

Rule #1. Keep away from the big bullies in the playground. (Avoid the strongest signals.)

Rule #2. Share your toys. (Minimize your transmitted power. Use the shortest hop distances feasible. Minimize average power density per Hertz.)

Rule #3. If you have nothing to say, keep quiet.

Rule #4. Don't pick on the big kids. (Don't step on strong signals. You're going to get clobbered.)

Rule #5. If you feel you absolutely must beat up somebody, be sure to pick someone smaller than yourself. (Now this is a less obvious one, as weak signals represent far away transmissions; so your signals will likely be attenuated the same amount in the reverse direction and probably not cause significant interference.)

Rule #6. Don't get too close to your neighbor. Even the weakest signals are very strong when they are shouted in your ear.

Rule #7. Lastly, don't be a cry baby. (If you insist on using obsolete technology that is highly sensitive to interfering signals, don't expect much sympathy when you complain about interfering signals in a shared band.)

- Large “no protection from interference” label
- SOME power limits, but not as draconian as 5 GHz
- No swarming
- Must publish (ala open source) complete technical description of modulation used – not to say that it can be copied by anyone (patents still apply, for example), but so that other companies can see exactly what you’re doing, and how to work around it.

Chapter 13

Epilogue – *Should We Have An Anything Goes Band?*

(to be completed)

- Could this idea work?
- Discuss robust modulation methods
 - RadioLAN, WIMAN, Wi-LAN / W-OFDM, Motorola
- Why there should not be a spectrum-sharing etiquette
- Applicability of 802.16a

Why is such an “anything goes” band needed?

Some telling points were presented¹⁰ at the same conference by Martin Cave, of the Centre For Management Under Regulation, Warwick Business School:

- Spectrum: asset of large and growing importance, crucial to success of many industries in which the UK can excel
- Rapid (difficult to predict) changes need more flexibility
- Regime for allocating spectrum has grown up which:
 - relies largely on administrative measures
 - fails to ensure that best use is made of the spectrum
- Vital to ensure that adequate spectrum is available in the public sector to ensure the delivery of services
- Spectrum is an input: issue of spectrum use should be decoupled from final output decisions (eg. expenditure on defence or public service broadcasting)

Cave goes on to describe the merits and deficiencies of the various forms of “human-based spectrum management” – auctions, beauty contests, etc.

Cave’s second point is most relevant to the discussion of an “Anything Goes” band. In the Internet era, requirements change *rapidly*, vastly outstripping the ability of “human-based spectrum management” to react to such requirements. The primary quality of the Internet that has led to its overwhelming success is that new capabilities can be implemented quickly.

Allocation of new spectrum takes years... some changes to spectrum allocation have, incredibly, taken (and yes, literally) decades. Such long timelines are completely and utterly useless in the rapid evolution of technology in the Internet Era.

¹⁰ Conference presentation can be found online at
<http://www.calit2.net/events/2002/Spectrum/presentations/mec828.ppt>

Chapter 14

Postscript – The *Real* “Anything Goes Band”

In my research, I did a number of web searches, and received an interesting result from searching Google for “anything goes band”:



This “Anything Goes Band” is apparently an amateur theatre production in Corvallis, OR. Left to right: Dana Megowan (percussion), Larry Landis (trumpet), Don Phillips (tenor sax), Bill Lanham (banjo/guitar), Ray Drapek (piano), Aaron Gallant (clarinet/tenor sax), Joe Sikich (drums), Rob Birdwell (music director, trumpet, "Gabriel"), Stuart Curtis (alto sax, clarinet, flute), Sarah Bronstein (clarinet), Kelli Brooks (bass). Not pictured are James Gallant (trombone), Doug Hall (drums), Cathy Sams (piano)

Notes

Potential Additional Interviews:

- WISPs
 - Urban
 - TowerStream
 - Rural
 - Marlon Schafer
- Free Wireless Networks
 - SF Net
 - Seattle Wireless
- Amateur Radio
 - Phil Karn
 - Dale Hatfield
 - Bdale Garbee
- Equipment vendors
 - Alvarion
 - Proxim
- Scientific
 - Dave Hughes
- Technical competitiveness
 - Will this keep the US in the forefront, like it did with 2.4 GHz?
- Regulatory
 - FCC
 - Lawrence Lessig
- Industry pundits / analysts
 - David Isenberg
 - David Reed
 - Mark Anderson
 - Rich Karlgaard
 - Tim O'Reilly

About the Author

Steve Stroh is Editor of *Focus On Broadband Wireless Internet Access*, an independent newsletter that examines the companies, technologies, and developments that are creating the Broadband Wireless Internet Access industry. Steve began writing about Broadband Wireless Internet Access in early 1997 with the debut of his column Wireless Data Developments in Boardwatch Magazine. Steve has written for numerous other publications including Broadband Wireless Business Magazine. More information on Steve is available on his web page at www.strohpub.com.

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Focus

On Broadband Wireless Internet Access

Steve Stroh, Editor

www.strohpub.com/focussub.pdf

Since beginning my professional writing career, I have specialized in the emergence of Broadband Wireless Internet Access. Many readers have repeatedly told me how valuable my articles and columns in Boardwatch Magazine, CLEC Magazine, Broadband Wireless Business Magazine, and other publications have been to them in understanding the companies and technologies of the Broadband Wireless Internet Access industry. I've been asked many times if there was any way to read more of what I have written about Broadband Wireless Internet Access. In answer to those readers, in June, 2001 I began publication of a newsletter- *Focus On Broadband Wireless Internet Access*.

Focus is founded upon the following tenets:

1. Internet technology is becoming the foundation for nearly all communications, commerce, and entertainment services;
2. For Internet access to be truly usable, always-on Broadband Internet access is required;
3. By the end of the first decade of the 21st century, Internet access will be ubiquitous;
4. In the "last mile", wireline-based technologies and systems will generally prove to be insufficient or not cost-effective to provide ubiquitous, always-on, Broadband Internet to most homes and businesses;
5. In the near term, Broadband Wireless Internet Access in all its forms – Sub 11 GHz, Above 11 GHz, Free Space Optics, Ultra Wideband, Licensed, License-exempt has emerged as *the most likely technology* to provide cost-effective, ubiquitous, always-on Broadband Internet Access.

Focus on Broadband Wireless Internet Access is written in an informal, easy-to-read style, with an emphasis on clear explanations of why a particular company, product, or development in the Broadband Wireless Internet Access industry is significant. **Focus** is not an investment newsletter, merely recommending or highlighting particular companies for their investment potential. Each issue contains a number of *original*, in-depth articles and news stories. **Focus** is a just-in-time, short-lead-time publication, using Adobe Acrobat (.pdf) format, and email distribution

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I intend that *Focus On Broadband Wireless Internet Access* will be in a state of continuous evolution. My promise to readers is that **Focus** will be relevant, honest, and interesting. To subscribe to **Focus**, please see the subscription information at www.strohpub.com/focussub.pdf.

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